29"CRT Display Unit

ver 1.2

Service Manual
29E31S

Rev: B

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SAFETY INSTRUCTIONS

Display Unit 29E31S

WARNING: BEFORE SERVICING THIS CHASSIS, READ THE "X-RAY RADIATION PRECAUTION" "SAFETY PRECAUTION" AND "PRODUCT SAFETY NOTICE" DESCRIBED BELOW.

X-RAY RADIATION PRECAUTION

1. Excessive high voltage can produce potentially hazardous X-RAY RADIATION. To avoid such hazardous, the high voltage must not be above the specified limit. The nominal value of the high voltage of this unit is 27kV at zero beam current (minimum brightness)between 85~132V AC power source.
   The high voltage must not, under any circumstances, exceed 27.0kV. Each time a unit requires servicing, the high voltage should be checked following the HIGH VOLTAGE CHECK procedure on page 2 of this manual.It is recommended that the reading of the high voltage be recorded as a part of the service record. It is important to use an accurate and reliable high voltage meter.
2. This unit is equipped with a Fail Safe (FS)circuit which prevents the receiver from producing an excessively high voltage even if the B+ voltage increases abnormally. Each time the unit is serviced, the FS circuit must be checked to determine that the circuit is properly functioning, following the FS CIRCUIT CHECK procedure on page 3 of this manual.
3. The only source of X-RAY RADIATION in this unit is the picture tube. For continued X-RAY RADIATION protection, the replacement tube must be exactly the same tube as specified in the parts list.
4. Some parts in this unit have special safety related characteristics for X-RAY RADIATION protection. For continued safety, parts replacement should be undertaken only after referring to the PRODUCT SAFETY NOTICE below.

SAFETY PRECAUTION

1. Potentials as high as 27kv is present when this unit is operating.
   1) Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.
   2) Always discharge the picture tube anode to the chassis to keep off the shock hazard before removing the anode cap.
   3) Perfectly discharge the high potential of the picture tube before handling. The picture tube is highly evacuated and if broken, glass fragments will be violently expelled.
2. If any FUSE in this unit is blown, replace it with the FUSE specified in the chassis parts list.
3. When replacing parts or circuit board, wind the lead wires around the terminals before soldering.
4. When replacing a high wattage resistor (oxide metal film)in circuit board, keep the resistor 10mm away from circuit board.
5. Keep wires away from high voltage or high temperature components.
6. This unit can be operated under AC100-120volts, 50/60Hz. NEVER connect to DC supply or any other power.

HIGH VOLTAGE CHECK

CAUTION: There is HIGH VOLTAGE ADJUSTMENT on this chassis. The H.V. ADJ.VR(VR401)must be properly adjusted to insure the correct high voltage.

1. Connect an accurate high voltage meter to the anode of the picture tube.
2. Turn on the unit(100% white window). Set the BRIGHTNESS at center and CONTRAST to the maximum.
3. High voltage will be measured below 27.5kv.
4. Rotate the contrast control to both extremes to be sure the high voltage does not exceed the limit under any conditions.

CAUTION: The international hazard symbols in the schematic diagram and the

Display Unit 29E31S

CAUTION: The international hazard symbols in the schematic diagram and the parts list designate components which have special Characteristics important for safety and should be replaced only with types identical to those in the original circuit or specified in the parts list. The mounting position of replacements is to be identical with originals. Before replacing any of these components, read carefully the PRODUCT SAFETY NOTICE on this page. Do not degrade the safety of the receiver through improper servicing.

PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in this chassis have special safety related characteristics. These Characteristics are often passed unnoticed by a visual inspection and the protection afforded by them can not necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this manual and its supplements; electrical components having such features are identified by the international hazard symbols on the schematic diagram and the parts list. Before replacing any these components, read the parts list in this manual carefully. The use of substitute replacement parts which do not have the same safety Characteristics as specified in the parts list may create shock, fire, X-ray radiation or other hazards .

FS CIRCUIT CHECK

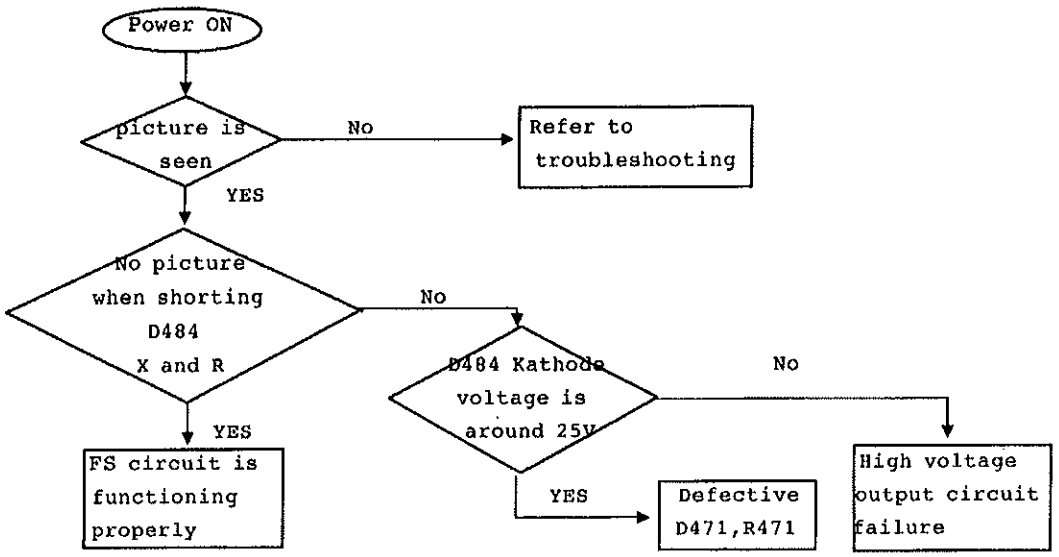
The fail safe(FS) circuit check is indispensable for the final check in the servicing. Checking should be done following the steps below.

1. Turn the power switch on and adjust controls for nominal operation.
2. Temporarily short terminal the D484 on main board with a jumper wire. Raster will disappear.
3. The unit must remain in this state even after removing the jumper wire. This is the evidence that the FS circuit is functioning properly.
4. To obtain a picture again, temporarily turn the power off and allow the FS circuit more than 30 seconds to reset. Then turn the power switch on to produce a normal picture.

Fail safe circuit

The fail safe circuit samples horizontal pulses of a flyback transformer should the high voltage rise above normal limits. The fail safe circuit activates and prevents excessive anode voltage from being developed.

Troubleshooting guide for fail safe circuit



Display Unit 29E31S

1. SPECIFICATION

1.1 CRT

29-inch, 108° deflection,
Full Square Picture Tube
Dot pitch : 0.80mm(at center),
0.96mm(at corner),
0.64mm(vertical)
Phosphor : Y22

1.2 POWER INPUT

(1) Voltage : 100V to 120V
(2) Frequency : 50Hz/60Hz
(3) Input current : 2.5A(maximum)
(4) Inrush current : 72Ap.p.(max.)
(5) Power dissipation : 160±20W

1.3 SCANNING FREQUENCY

(1)Horizontal(fH): 31.5KHz±500Hz
Retrace Time :within 5μsec
(2) Vertical(fV) : 55~70Hz
Retrace Time :within 1msec

1.4 SIGNAL INPUT

(1)Video Signal
a)Analog R,G,B
b)Positive 0.7v
c)Impedance 75Ω terminated
(2) Sync. Signal
a)Horizontal
composite sync : 1~5Vpp
separate sync(nega): 3~5Vpp
b)Vertical
separate sync(nega): 3~5Vpp

1.5 SIGNAL TIMING

See the recommend timing below.
(Table.1)

1.6 INPUT SOCKET

(1)AC Input : AMP15-PIN connector
(2)Signal Input : D-SUB 15-PIN

1.7 DISPLAY SCREEN SIZE

(1)Horizontal : 540.8mm
(2)Vertical : 405.6mm

1.8 IMAGE CHARACTERISTICS

(1) Linearity
Horizontal : within ±10%
Vertical : within ±8%
(2) Image Distortion
H/V trapezoid : within 3%
Pincushion : within 3%
Tilt : within ±4mm
(3) Mis-Convergence
Zone A :within 1.5mm
*Inside a circle of 60% diameter of the screen height
Zone B :within 2.5mm
*Inside a circle of a diameter equal to the screen height (except zone A)
Zone C : within 3mm
*Outside the zone A,B
(4) Jitter
Not identified 50mmm away from CRT.
(5) Video
Resolution: 676 dots x 625 lines
*calculated by (effective screen size)/(phosphor dot pitch)
Clock Frequency :20MHz Typ.
(6) White Balance
x=0.285±0.02
y=0.285±0.02
Color Temperature:Approx.9700K

1.9 AMBIENT CONDITION

(1)Temperature
Operating : 0~40℃
Storage : -10~60℃
(2)Humidity
Operating : under 70%
Storage : under 80%

2.0 DIMENSION

594(H)x624(W)x488(D)mm

2.1 WEIGHT

Approx. 43.0kg

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■ INPUT SIGNAL CONNECTOR

(1)AMP 15-PIN

PIN No	INPUT SIGNAL	SPECIFICATION
1	NC	—
2	NC	—
3	NC	—
4	NC	—
5	NC	—
6	AC Input	Nominal AC Voltage Input
7	AC Input	Nominal AC Voltage Input
9	Degauss SW	Connection to Degaussing Switch
10	Degauss SW	Connection to Degaussing Switch

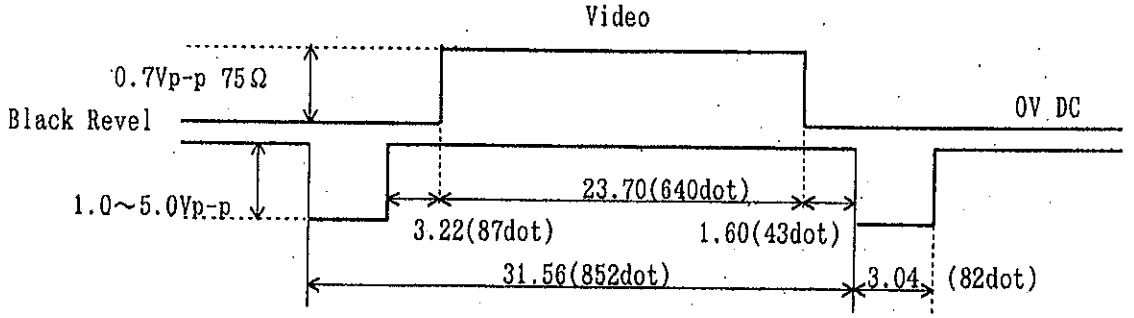
(2)D-SUB 15-PIN

PIN No	INPUT SIGNAL	SPECIFICATION
1	Red	Posi. 0.7Vpp 75Ω
2	Green	ditto
3	Blue	ditto
4	GND	—
5	NC	—
6	Red GND	—
7	Green GND	—
8	Blue GND	—
9	NC	—
10	GND	—
11	GND	—
12	NC	—
13	H.SYNC	CS Sync 1-5Vpp Sepa Sync 3-5Vpp
14	V.SYNC	Sepa Sync 3-5vpp
15	NC	—

■ RECOMMENDED SIGNAL TIMING

31.69KHz

HORIONTAL TIMING (UNIT: μ sec)



VERTICAL TIMING (UNIT: msec)

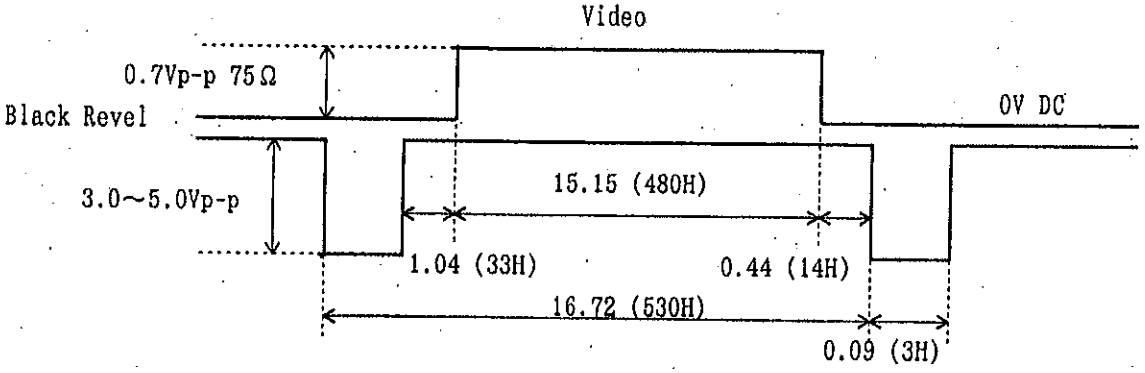
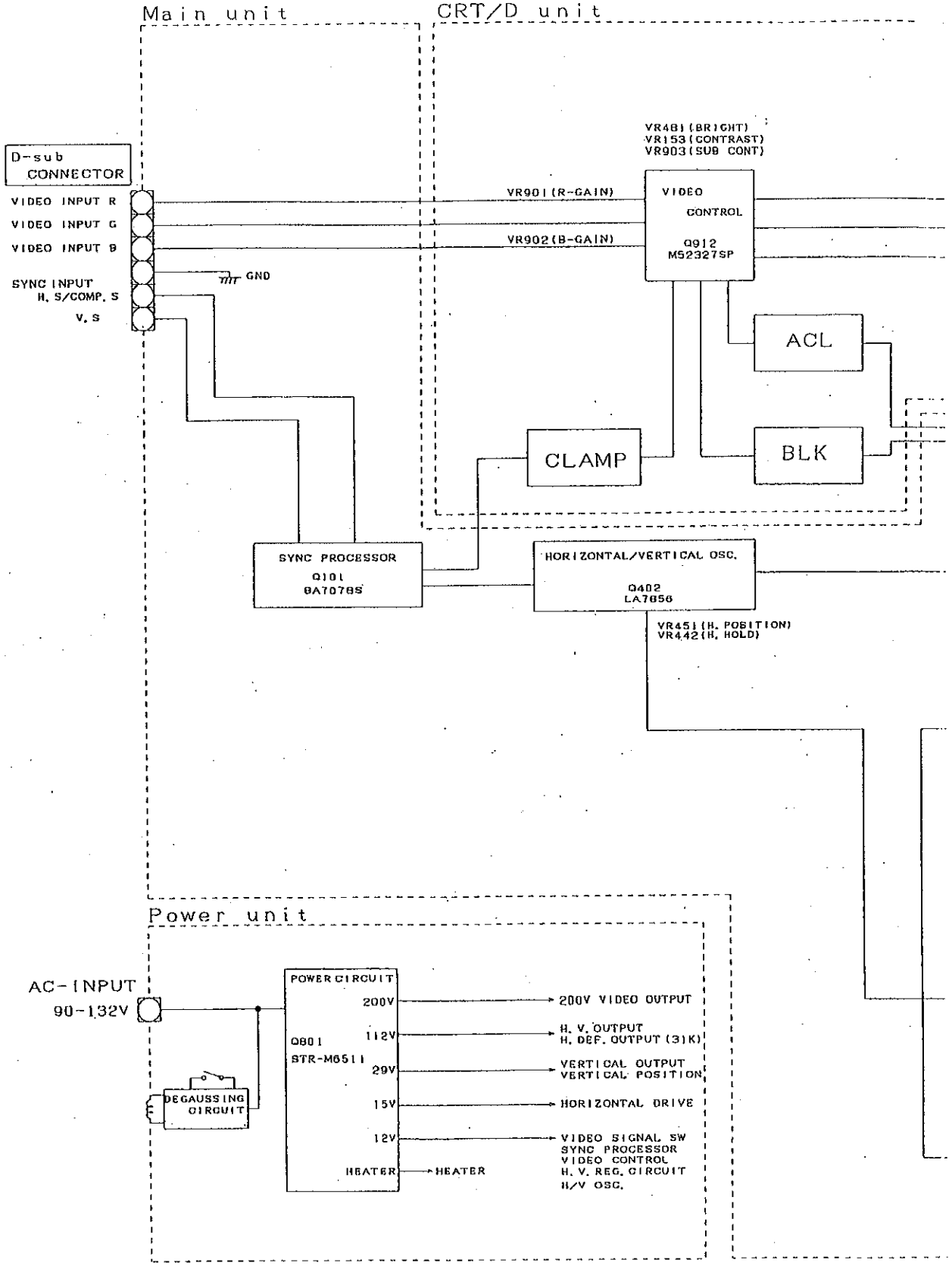
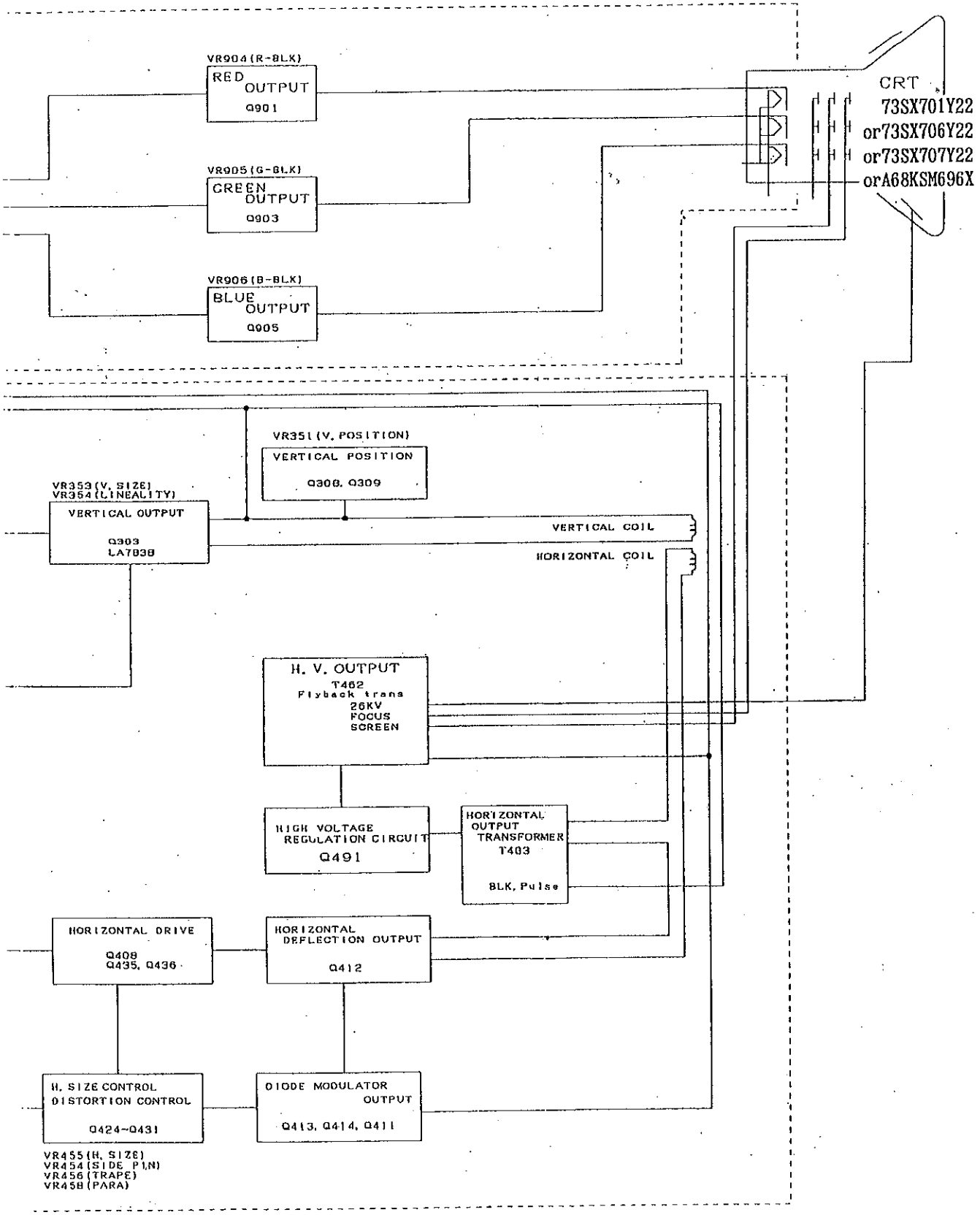


Table.1

2. CIRCUIT BLOCK DIAGRAM



it Circuit Block Diagram



3. ADJUSTMENT

3.1 Horizontal Synchronization Adjustment

input signal frequency VGA or naomi. Adjust for VR442(H.Hold) so the Picture Hold.

3.2 High Voltage Adjustment(VR401)

Adjust VR401 so that the anode voltage of CRT is approx.27kV.
Do not rotate VR401 after the factory adjustment because, this adjustment affects X-ray radiation protection.

3.3 Geometry Adjustment

Adjustment of geometry should be made following procedure.

①Horizontal Position Adjustment with VR451(H.POSI)
②Vertical Linearity Adjustment with VR354(V.LIN)
③Vertical Position Adjustment with VR351(V.POSI)
④Horizontal and Vertical size adjustment with VR455(H.SIZE) and VR353(V.SIZE)
⑤Pincushion Amplitude Correction(PIN AMP VR454)
⑥T/B Trapezoid Correction(T/B TRAPE VR456)
⑦Parallelogram Correction(PARA VR458)

Repeat above procedure for the optimum geometry.

3.4 White Balance Adjustment

Adjustment of White Balance should be made following procedure.
Before performing adjustment, preset the controls(VR112,VR903,VR901, VR902,VR904,VR905,VR906)to the center and warming-up of the set for 30 minutes.

①Receive black video signal. Increase the screen gradually and set it to the position where the first appeared color lights up slightly.
②Adjust the cutoff VR's (R.BLK(VR904), G.BLK(VR905), B.BLK(VR906)) of two other colors which were not appeared in step ①, for the 9700k color temperature.(x=0.285±0.02,y=0.285±0.02,Y=10±2)
③Rotate the screen to adjust the brightness of back raster just before disappeared.
④Receive 100% white window signal. Adjust the color temperature to 9700K with gain VR's(R.gain(VR901),B.gain(VR902)) and Sub.CONT VR(VR903). (x=0.285±0.03,y=0.285±0.03,Y=120±3)
⑤Rotate the Contrast VR(VR112) to the minimum. Adjust the cutoff VR's (R.BLK(VR904), G.BLK(VR905), B.BLK(VR906))of two other colors which were not appeared in step ①, for the 9700K color temperature. (x=0.285±0.03,y=0.285±0.03)

3.5 Focus Adjustment

Adjust the focus of all over the screen to the optimum.

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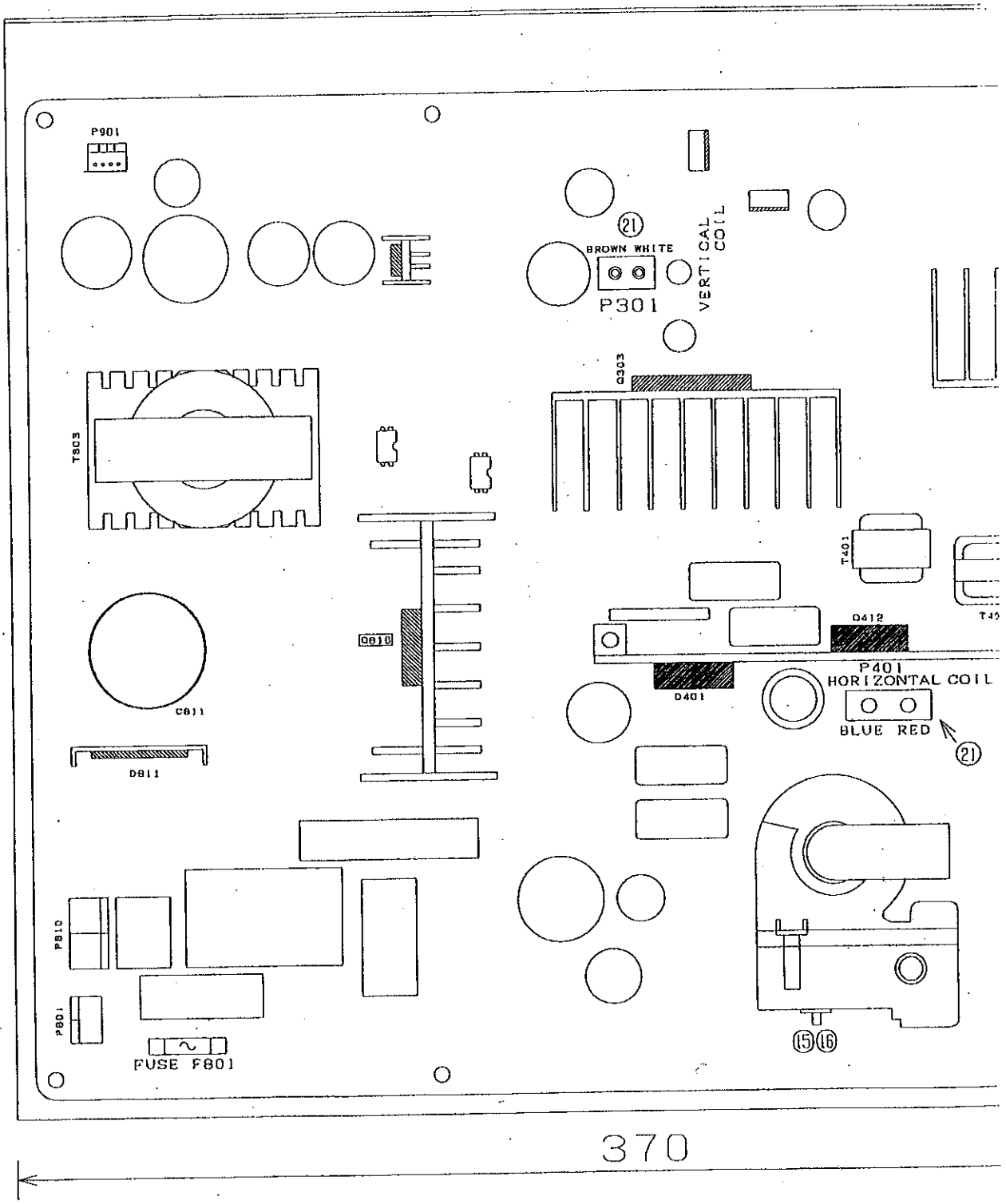
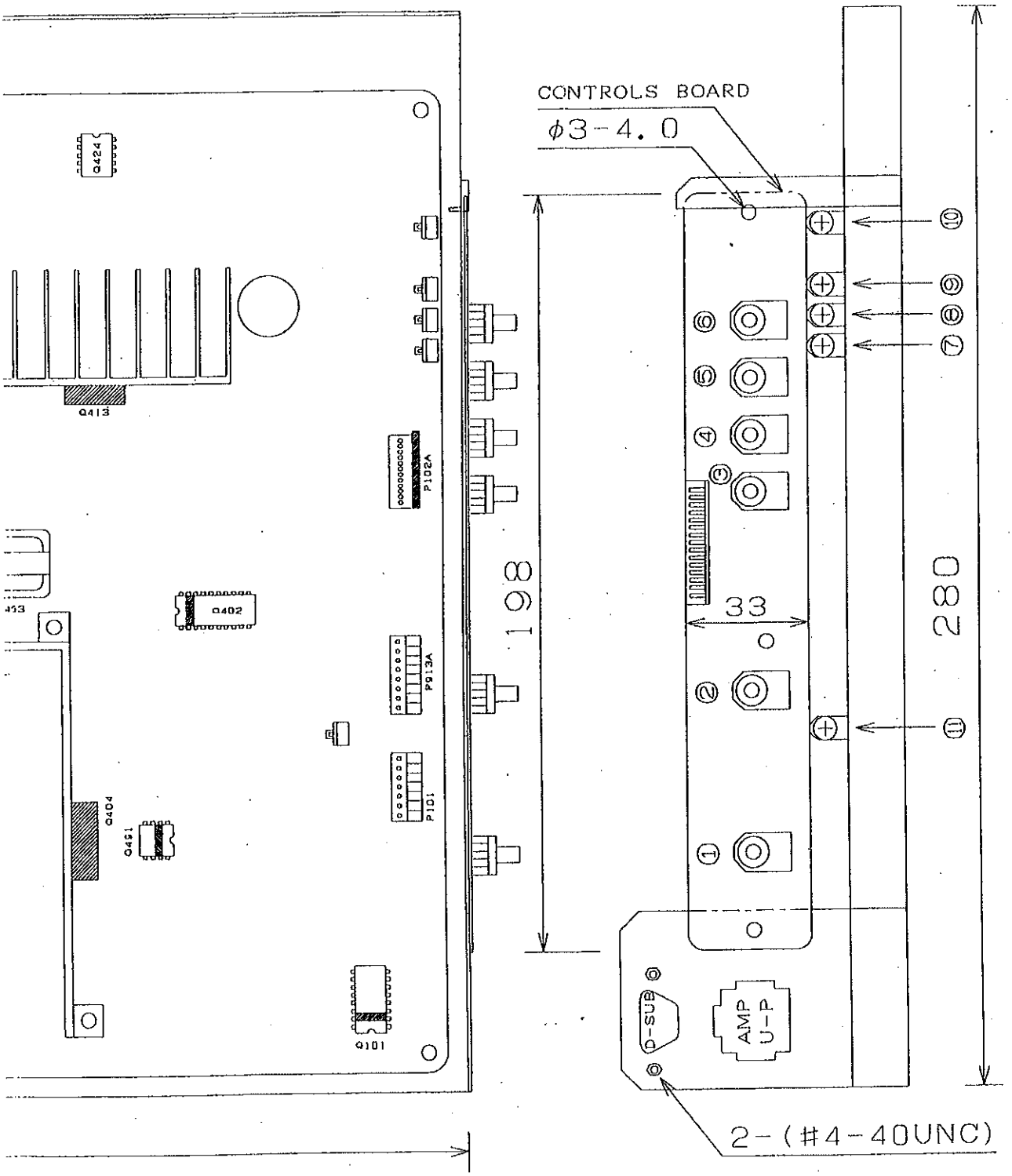
4. ADJUSTING CONTROLS LAYOUT

MAIN BOARD




CONTROLS BOARD
φ3-4.0
198
33
280
2-(#4-40UNC)
D-SUB
AMP
U-P
Q424
Q413
Q402
Q404
Q451
Q101
P102A
P913A
P101

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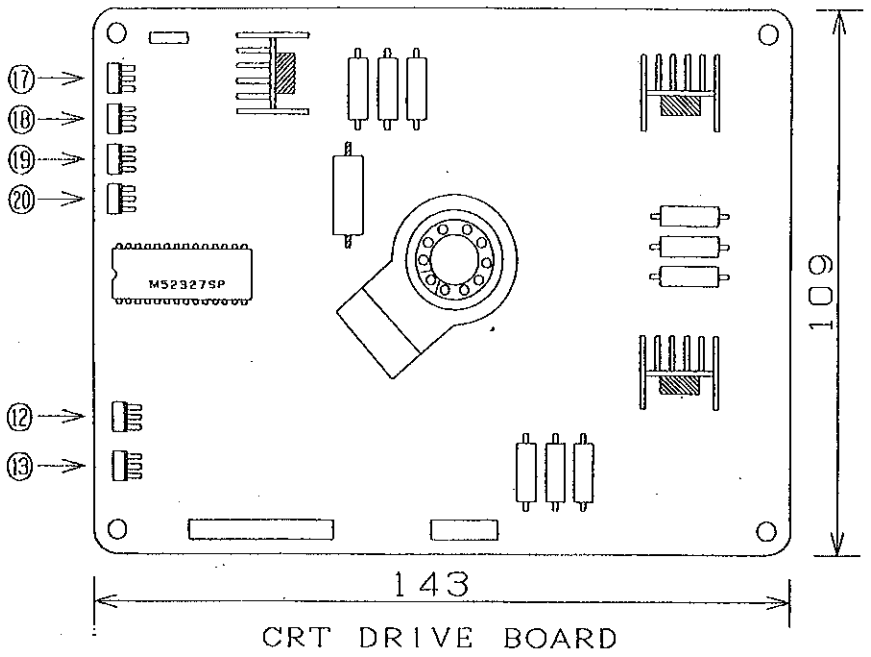


⑰ SUB CONT (VR903) SUBCONTRAST ADJUSTMENT
Adjustment for the maximum CONTRAST.

⑱ R-BLK (VR904) RED CUTOFF ADJUSTMENT
Turn the pot clockwise to increase the red color.

⑲ G-BLK (VR905) GREEN CUTOFF ADJUSTMENT
Turn the pot clockwise to inorease the green oolor.

⑳ B-BLK (VR906) BLUE CUTOFF ADJUSTMENT
Turn the pot clockwise to inorease the blue color.

㉑ CONNECTOR FOR DEFLECTION YORK POLARITY SWITCH

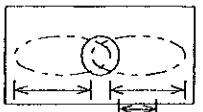
P301

P401 \	NORMAL	REVERSE
NORMAL	SANWA normal image	SANWA top and bottom reversed image
REVERSE	SANWA right and left reversed image	SANWA 180° degree rotated image

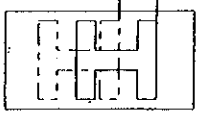
① CONTRAS
② BRIGHT
③ H. SIZE
④ H. POSI
⑤ V. SIZE
⑥ V. POSI
⑦ PARA
⑧ PIN AMP
⑨ T/B TRAP
⑩ V. LIN
⑪ HOLD
⑫ R. GAIN
⑬ B. GAIN
⑮ FOCUS
⑯ SCREEN

(VR112) CONTRAST ADJUSTMENT
Turn the pot clockwise to increase the CONTRAST.

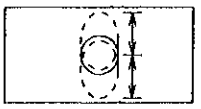
(VR481) BRIGHTNESS ADJUSTMENT
Brightness adjustment for the raster.
Turn the pot clockwise to increase the brightness.



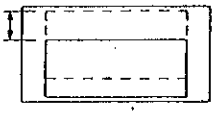
(VR455) HORIZONTAL SIZE ADJUSTMENT
Adjustment for horizontal raster size.



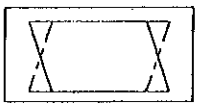
(VR451) HORIZONTAL POSITION ADJUSTMENT
Adjustment for horizontal image position.



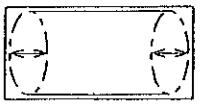
(VR353) VERTICAL SIZE ADJUSTMENT
Adjustment for vertical raster size.



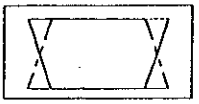
(VR351) VERTICAL POSITION ADJUSTMENT
Adjustment for vertical image position.



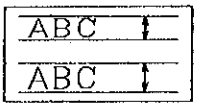
(VR458) PARALLELOGRAM DISTORTION CORRECTION
Adjustment for parallelogram distortion.



(VR454) PINCUSHION DISTORTION CORRECTION
Adjustment for pincushion distortion.



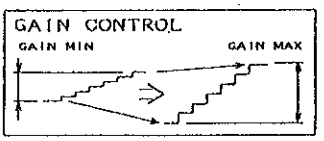
(VR456) TRAPEZOID DISTORTION CORRECTION
Adjustment for trapezoid distortion.



(VR354) VERTICAL LINEARITY ADJUSTMENT
Adjustment for vertical linearity of top and bottom portion.

(VR442) HORIZONTAL SYNCHRONIZATION ADJUSTMENT
Adjustment the pot when the image flows laterally.

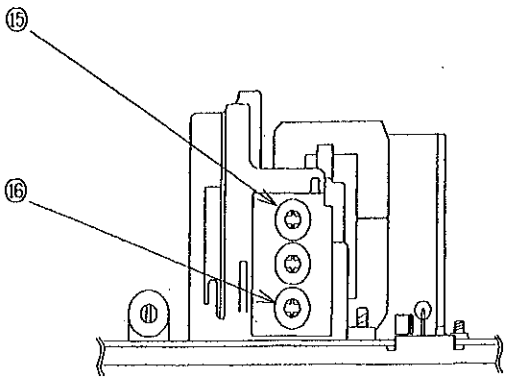
(VR901) RED GAIN ADJUSTMENT
Turn the pot clockwise to increase the RED color gain.



(VR902) BLUE GAIN ADJUSTMENT
Turn the pot clockwise to increase the BLUE color gain.

FOCUS ADJUSTMENT
Adjustment the beam focus to the optimum.

SCREEN ADJUSTMENT
Adjustment raster brightness to cutoff point. (back raster just disappear)



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CHASSIS REPLACEMENT PARTS LIST

WANING: BEFORE SERVICING THIS CHASSIS, READ THE"X-RAY RADIATION PRECAUTION ","SAFETY PRECAUTION"AND"PRODUCT SAFETY NOTICE"ON PAGE 2 OF THIS MANUAL.

CAUTION: The international hazard symbols in the schematic diagram and the pa-rts list designate components which have special characteristics important for safety and should be replaced only with types identical to those is the origi-nal circuit or specified in the parts list.
The mounting position of replacements is to be identical with originals.Before repelacing any of these components, read carefully the PRODUCT SAFETY NOTICE on page 3.
Do not degrade the safety of the receiver through improper servicing.

NOTICE: The part number most be used when ordering parts , in order to assistIn processing, be sure to include the Model number and Description.

Model 29E31S

ABBREVIATION

Capacitors... CD: Ceramic Disk PF: Plastic Film EL: Electrolytic
TE: Tantalum Electrolytic ELN: Non pole

Resistors ... CF: Carbon Film OMF: Oxide Metal Film VR: Variable Resistor
FR: Fusible Resistor

(ALL CD and PF capacitors are ±5%, 50V and all resistors, ±5%, 1/6W unless otherwise noted.)

Location No.	Part.	Description
CAPACITORS		
C101	Capacitor	EL, 4.7uF, ±20%, 50V
C102	Capacitor	EL, 1uF, ±20%, 50V
C103	Capacitor	EL, 0.47uF, ±20%, 50V
C104	Capacitor	EL, 2.2uF, ±20%, 50V
C105	Capacitor	EL, 1uF, ±20%, 50V
C106	Capacitor	PF, 0.01uF, ±10%, 50V
C107	Capacitor	EL, 47uF, ±20%, 25V
C108	Capacitor	CD, 270pF, ±5%, 50V
C302	Capacitor	PF, 0.1uF, ±5%, 63V
C305	Capacitor	EL, 220uF, ±20%, 16V
C306	Capacitor	EL, 100uF, ±20%, 25V
C307	Capacitor	PF, 0.1uF, ±5%, 63V
C308	Capacitor	TE, 1uF, ±20%, 35V
C309	Capacitor	EL, 1uF, ±20%, 50V
C310	Capacitor	EL, 100uF, ±20%, 35V
C313	Capacitor	EL, 220uF, ±20%, 35V
C314	Capacitor	EL, 3300uF, ±20%, 25V
C315	Capacitor	EL, 1uF, ±20%, 50V
C317	Capacitor	EL, 470uF, ±20%, 25V
C318	Capacitor	PF, 0.027uF, ±10%, 100V
C320	Capacitor	PF, 0.01uF, ±10%, 50V
C323	Capacitor	CD, 8200pF, ±10%, 50V
C324	Capacitor	CD, 5P, ±5%, 100V
C328	Capacitor	EL, 10uF, ±20%, 50V
C401	Capacitor	CD, 100pF, ±5%, 50V
C402	Capacitor	PF, 1000pF, ±5%, 50V

Location No.	Part.	Description
C403	Capacitor	PF, 270pF, ±5%, 100V
C404	Capacitor	PF, 3300pF, ±5%, 50V
C405	Capacitor	EL, 1uF, ±20%, 50V
C406	Capacitor	PF, 0.015uF, ±5%, 50V
C407	Capacitor	PF, 2700pF, ±5%, 50V
C408	Capacitor	EL, 1uF, ±20%, 50V
C409	Capacitor	EL, 470uF, ±20%, 16V
C410	Capacitor	PF, 0.1uF, ±5%, 63V
C412	Capacitor	CD, 3300pF, ±10%, 500V
C413	Capacitor	CD, 390pF, ±10%, 500V
C416	Capacitor	PF, 3900pF, ±5%, 2KV
C417	Capacitor	PF, 3900pF, ±5%, 2KV
C419	Capacitor	PF, 0.18uF, ±5%, 400V
C421	Capacitor	EL, 47uF, ±20%, 50V
C422	Capacitor	PF, 5600pF, ±5%, 1.6KV
C423	Capacitor	EL, 4.7uF, ±20%, 100V
C424	Capacitor	EL, 470uF, ±20%, 160V
C426	Capacitor	EL, 33uF, ±20%, 160V
C427	Capacitor	EL, 330uF, ±20%, 35V
C428	Capacitor	PF, 2200pF, ±5%, 1.6KV
C429	Capacitor	EL, 100uF, ±20%, 25V
C430	Capacitor	PF, 0.22uF, ±5%, 400V
C432	Capacitor	CD, 6800pF, ±10%, 50V
C433	Capacitor	EL, 33uF, ±20%, 160V

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C434	Capacitor	PF,0.27uF,±10%,100V
C436	Capacitor	PF,0.1uF,±5%,63V
C437	Capacitor	ELN,33uF,±20%,50V
C438	Capacitor	EL,470uF,±20%,25V

Location No.	Part.	Description
C439	Capacitor	EL,33uF,±20%,35V
C440	Capacitor	PF,0.1uF,±5%,63V
C441	Capacitor	EL,10uF,±20%,50V
C442	Capacitor	PF,0.01uF,±10%,50V
C446	Capacitor	EL,10uF,±20%,50V
C447	Capacitor	EL,10uF,±20%,50V
C449	Capacitor	PF,0.47uF,±5%,AC250
C452	Capacitor	EL,10uF,±20%,50V
C453	Capacitor	PF,0.1uF,±5%,63V
C454	Capacitor	CD,390pF,±10%,500V
C456	Capacitor	ELN,10uF,±20%,50V
C471	Capacitor	EL,47uF,±20%,50V
C474	Capacitor	EL,1uF,±20%,50V
C481	Capacitor	EL,10uF,±20%,50V
C4A1	Capacitor	CD,3300pF,±10%,50V
C4A2	Capacitor	PF,0.01uF,±10%,50V
C4A3	Capacitor	PF,0.01uF,±10%,50V
C4A4	Capacitor	PF,0.1uF,±5%,63V
C4A5	Capacitor	CD,27pF,±5%,50V
C4A6	Capacitor	EL,22uF,±20%,16V
C4A7	Capacitor	EL,10uF,±20%,25V
C4A8	Capacitor	PF,0.01uF,±10%,50V
! C801	Capacitor	PF,0.22uF,±20%,AC250V
! C804	Capacitor	CD,4700pF,±20%,AC250V
! C805	Capacitor	CD,4700pF,±20%,AC250V
! C806	Capacitor	CD,4700pF,±20%,AC250V
! C807	Capacitor	CD,3300pF,±20%,AC250V
! C808	Capacitor	CD,3300pF,±20%,AC250V
C810	Capacitor	PF,0.033uF,±5%,630V
C811	Capacitor	EL,1000uF,±20%,200V
C812	Capacitor	CD,2±10%V,1500pF,±10%
C813	Capacitor	CD,3±10%V,150pF,±10%
C814	Capacitor	CD,120pF,±5%,500V
C815	Capacitor	CD,1000pF,±10%,500V
C816	Capacitor	CD,2±10%V,1500pF,±10%
C817	Capacitor	CD,330pF,±10%,500V
C818	Capacitor	CD,1000pF,±10%,500V
C819	Capacitor	CD,330pF,±10%,500V
C820	Capacitor	CD,330pF,±10%,500V
C821	Capacitor	EL,220uF,±20%,50V
C822	Capacitor	EL,1uF,±20%,50V
C831	Capacitor	EL,33uF,±20%,250V
C833	Capacitor	EL,100uF,±20%,160V
C834	Capacitor	EL,1000uF,±20%,50V
C835	Capacitor	EL,1000uF,±20%,35V
C836	Capacitor	EL,2200uF,±20%,10V
C837	Capacitor	PF,0.1uF,±5%,63V
C838	Capacitor	PF,0.1uF,±5%,63V
C839	Capacitor	EL,10uF,±20%,50V(16V)
C840	Capacitor	EL,1000uF,±20%,6.3V
C841	Capacitor	PF, 0.1uF,±20%,400V
C851	Capacitor	EL,100uF,±20%,16V
C852	Capacitor	EL,10uF,Not leak,50V
C901	Capacitor	PF,0.1uF,±5%,63V
C902	Capacitor	CD,1500pF,±10%,50V
C903	Capacitor	PF,0.1uF,±5%,63V

C904	Capacitor	CD,1500pF,±10%,50V
C905	Capacitor	PF,0.1uF,±5%,63V
C906	Capacitor	CD,1500pF,±10%,50V
C907	Capacitor	CD,2±10%V,4700pF,±20%
C908	Capacitor	EL,100uF,±20%,25V

Location No.	Part.	Description
C910	Capacitor	CD,0.01uF,Z,50V
C911	Capacitor	EL,47uF,±20%,25V
C912	Capacitor	EL,47uF,±20%,25V
C913	Capacitor	EL,47uF,±20%,25V
C915	Capacitor	EL,100uF,±20%,25V
C917	Capacitor	CD,0.01uF,Z,50V
C919	Capacitor	CD,0.01uF,Z,50V
C921	Capacitor	CD,0.01uF,Z,50V
C922	Capacitor	EL,3.3uF,±20%,50V
C925	Capacitor	EL,3.3uF,±20%,50V
C927	Capacitor	EL,470uF,±20%,16V
C928	Capacitor	EL,1uF,±20%,50V
C929	Capacitor	PF,0.47uF,±10%,160V
C930	Capacitor	EL,1uF,±20%,50V
C931	Capacitor	CD,150pF,±5%,50V
C932	Capacitor	EL,1uF,±20%,50V
C934	Capacitor	CD,0.01uF,Z,50V
C940	Capacitor	CD,0.01uF,Z,50V
C941	Capacitor	CD,0.01uF,Z,50V
C942	Capacitor	EL,1uF,±20%,50V
C943	Capacitor	EL,10uF,±20%,50V

RESISTORS

R101	Resistor	CF,3.9KΩ,±5%,1/6W
R105	Resistor	CF,470Ω,±5%,1/6W
R106	Resistor	CF,470Ω,±5%,1/6W
R212	Resistor	CF,18KΩ,±5%,1/6W
R269	Resistor	CF,8.2KΩ,±5%,1/6W
R271	Resistor	CF,51KΩ,±5%,1/2W
R272	Resistor	CF,30KΩ,±5%,1/2W
R274	Resistor	CF,20KΩ,±5%,1/6W
R292	Resistor	CF,36KΩ,±5%,1/6W
R293	Resistor	CF,33KΩ,±5%,1/6W
R303	Resistor	CF,56Ω,±5%,1/6W
R306	Resistor	CF,270KΩ,±5%,1/6W
R307	Resistor	CF,22KΩ,±5%,1/6W
R308	Resistor	CF,18KΩ,±5%,1/6W
R313	Resistor	CF,10KΩ,±5%,1/6W
R315	Resistor	CF,2.2KΩ,±5%,1/6W
R316	Resistor	CF,27KΩ,±5%,1/6W
R318	Resistor	CF,33KΩ,±5%,1/6W
R319	Resistor	CF,10KΩ,±5%,1/6W
R320	Resistor	CF,1.8KΩ,±5%,1/6W
R324	Resistor	CF,30KΩ,±5%,1/6W
R325	Resistor	OMF,0.47Ω,±5%,1W
R329	Resistor	CF,4.7KΩ,±5%,1/6W
R330	Resistor	OMF,100Ω,±5%,2W
R332	Resistor	OMF,91Ω,±5%,2W

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R336	Resistor	CF,56Ω,±5%,1/6W
R338	Resistor	CF,47KΩ,±5%,1/6W

Location No.	Part.	Description
R339	Resistor	CF,39KΩ,±5%,1/6W
R347	Resistor	CF,0.82Ω,±5%,1/2W
R351	Resistor	CF,7.5KΩ,±5%,1/6W
R352	Resistor	CF,100KΩ,±5%,1/6W
R404	Resistor	CF,6.8KΩ,±5%,1/6W
R405	Resistor	CF,12KΩ,±5%,1/6W
R406	Resistor	CF,22KΩ,±5%,1/6W
R407	Resistor	CF,5.6KΩ,±5%,1/6W
R408	Resistor	OMF,0.33Ω,±5%,1W
R410	Resistor	CF,3.3KΩ,±5%,1/6W
R411	Resistor	CF,10KΩ,±5%,1/4W
R412	Resistor	CF,27KΩ,±5%,1/6W
R413	Resistor	CF,2.2KΩ,±5%,1/6W
R414	Resistor	CF,33KΩ,±5%,1/6W
R415	Resistor	CF,1KΩ,±5%,1/6W
R416	Resistor	CF,10KΩ,±5%,1/4W
R417	Resistor	CF,47Ω,±5%,1/4W
R419	Resistor	CF,12KΩ,±5%,1/4W
R420	Resistor	CF,12KΩ,±5%,1/4W
R421	Resistor	CF,10Ω,±5%,1/2W
R422	Resistor	CF,1KΩ,±5%,1/6W
R423	Resistor	CF,82Ω,±5%,1/2W
R424	Resistor	OMF,150KΩ,±5%,2W
R429	Resistor	CF,330Ω,±5%,1/2W
R430	Resistor	CF,75KΩ,±5%,1/6W
R436	Resistor	CF,2.2KΩ,±5%,1/6W
R440	Resistor	OMF,100Ω,±5%,3W
R444	Resistor	CF,510Ω,±5%,1/6W
R447	Resistor	CF,33KΩ,±5%,1/6W
R450	Resistor	CF,5.6KΩ,±5%,1/6W
R451	Resistor	CF,51Ω,±5%,1/6W
R454	Resistor	CF,360Ω,±5%,1/2W
R455	Resistor	CF,2.7Ω,±5%,1/2W
R456	Resistor	FR,0.39Ω,±5%,1/2W
R459	Resistor	CF,7.5KΩ,1/2W
R460	Resistor	CF,180Ω,±5%,1/6W
R461	Resistor	CF,470KΩ,±5%,1/6W
R462	Resistor	CF,10KΩ,±5%,1/6W
R463	Resistor	CF,10KΩ,±5%,1/6W
R467	Resistor	CF,30KΩ,±5%,1/6W
R471	Resistor	CF,2.7Ω,±5%,1/2W
R477	Resistor	CF,100KΩ,±5%,1/6W
R478	Resistor	CF,15KΩ,±5%,1/4W
R480	Resistor	CF,1.5KΩ,±5%,1/6W
R481	Resistor	CF,1.2KΩ,±5%,1/6W
R484	Resistor	CF,820Ω,±5%,1/6W
R487	Resistor	CF,680Ω,±5%,1/6W
R490	Resistor	CF,27Ω,±5%,1/2W

Location No.	Part.	Description
R491	Resistor	CF,470Ω,±5%,1/6W
R492	Resistor	CF,2.2KΩ,±5%,1/6W
R493	Resistor	CF,6.8KΩ,±5%,1/6W
R494	Resistor	CF,100KΩ,±5%,1/6W
R495	Resistor	CF,220KΩ,±5%,1/6W
R497	Resistor	CF,1KΩ,±5%,1/6W
R498	Resistor	CF,2.4KΩ,±5%,1/6W
R499	Resistor	CF,10Ω,±5%,1/6W
R4A0	Resistor	CF,9.1KΩ,±5%,1/6W
R4A1	Resistor	CF,200KΩ,±5%,1/6W
R4A2	Resistor	CF,7.5KΩ,±5%,1/6W
R4A3	Resistor	CF,1KΩ,±5%,1/6W
R4A4	Resistor	CF,47Ω,±5%,1/6W
R4A5	Resistor	CF,4.7KΩ,±5%,1/6W
R4A7	Resistor	CF,10Ω,±5%,1/6W
R4A8	Resistor	CF,10KΩ,±5%,1/6W
R4A9	Resistor	CF,1KΩ,±5%,1/6W
R4B1	Resistor	CF,10Ω,±5%,1/6W
R4B2	Resistor	CF,5.1KΩ,±5%,1/6W
R4B3	Resistor	CF,10KΩ,±5%,1/6W
R4B5	Resistor	CF,1KΩ,±5%,1/6W
R4B6	Resistor	CF,4.7KΩ,±5%,1/6W
R4B7	Resistor	CF,1KΩ,±5%,1/6W
R4B8	Resistor	CF,1KΩ,±5%,1/6W
R4B9	Resistor	CF,360Ω,±5%,1/2W
R4C8	Resistor	CF,2.7KΩ,±5%,1/6W
R802	Resistor	CF,1.2MΩ,±10%,1/2W
R808	Resistor	PTC Thermistor, PTH451A300BG3R0Q140
R810	Resistor	OMF,33KΩ,±5%,3W
R812	Resistor	CF,270KΩ,±5%,1/4W
R813	Resistor	Cement,8.2Ω,±5%,7W
R815	Resistor	CF,6.8KΩ,±5%,1/2W
R816	Resistor	CF,8.2KΩ,±5%,1/2W
R817	Resistor	OMF,330Ω,±5%,2W
R818	Resistor	OMF,0.18Ω,±5%,2W
R819	Resistor	OMF,0.18Ω,±5%,2W
R820	Resistor	CF,470Ω,±5%,1/2W
R821	Resistor	CF,1KΩ,±5%,1/6W
R822	Resistor	CF,510Ω,±5%,1/6W
R823	Resistor	CF,470Ω,±5%,1/6W
R824	Resistor	CF,470Ω,±5%,1/2W
R825	Resistor	CF,10KΩ,±5%,1/6W
R826	Resistor	CF,3KΩ,±5%,1/6W
R827	Resistor	CF,3.9KΩ,±5%,1/6W
R828	Resistor	CF,1KΩ,±5%,1/2W
R831	Resistor	CF,470KΩ,±5%,1/4W
R833	Resistor	OMF,0.12Ω,±5%,2W

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R838	Resistor	CF,3KΩ,±5%,1/2W

Location No.	Part.	Description
R839	Resistor	OMF,6.8KΩ,±5%,1W
R840	Resistor	CF,150Ω,±5%,1/6W
R842	Resistor	OMF,6.8KΩ,±5%,1W
R851	Resistor	CF,10KΩ,±5%,1/6W
R852	Resistor	CF,20KΩ,±5%,1/6W
R853	Resistor	CF,1KΩ,±5%,1/6W
R854	Resistor	CF,120Ω,±5%,1/2W
R855	Resistor	CF,3.3KΩ,±5%,1/6W
R857	Resistor	CF,100Ω,±5%,1/6W
R901	Resistor	CF,6.8KΩ,±5%,1/6W
R902	Resistor	CF,100Ω,±5%,1/6W
R903	Resistor	CF,390Ω,±5%,1/6W
R904	Resistor	CF,10Ω,±5%,1/6W
R905	Resistor	CF,82Ω,±5%,1/6W
R906	Resistor	CF,100Ω,±5%,1/6W
R907	Resistor	CF,100Ω,±5%,1/6W
R908	Resistor	CF,4.3KΩ,±5%,1/6W
R909	Resistor	OMF,15KΩ,±5%,2W
R910	Resistor	OMF,15KΩ,±5%,2W
R911	Resistor	OMF,15KΩ,±5%,2W
R912	Resistor	CF,7.5KΩ,±5%,1/6W
R913	Resistor	CF,560Ω,±10%,1/2W
R914	Resistor	CF,4.3KΩ,±5%,1/6W
R915	Resistor	CF,1KΩ,±5%,1/6W
R916	Resistor	CF,390Ω,±5%,1/6W
R917	Resistor	CF,10Ω,±5%,1/6W
R918	Resistor	CF,82Ω,±5%,1/6W
R919	Resistor	CF,1KΩ,±5%,1/6W
R920	Resistor	CF,1KΩ,±5%,1/6W
R921	Resistor	CF,10KΩ,±5%,1/6W
R922	Resistor	OMF,15KΩ,±5%,2W
R923	Resistor	OMF,15KΩ,±5%,2W
R924	Resistor	OMF,15KΩ,±5%,2W
R925	Resistor	CF,7.5KΩ,±5%,1/6W
R926	Resistor	CF,560Ω,±10%,1/2W
R927	Resistor	CF,1KΩ,±5%,1/6W
R928	Resistor	CF,75Ω,±5%,1/6W
R929	Resistor	CF,1KΩ,±5%,1/6W
R930	Resistor	CF,390Ω,±5%,1/6W
R931	Resistor	CF,6.8Ω,±5%,1/6W
R932	Resistor	CF,82Ω,±5%,1/6W
R933	Resistor	CF,1KΩ,±5%,1/6W
R935	Resistor	CF,75Ω,±5%,1/6W
R936	Resistor	OMF,15KΩ,±5%,2W
R937	Resistor	OMF,15KΩ,±5%,2W
R938	Resistor	OMF,15KΩ,±5%,2W
R939	Resistor	CF,75Ω,±5%,1/6W
R940	Resistor	CF,560Ω,±10%,1/2W

Location No.	Part.	Description
R941	Resistor	CF,680Ω,±5%,1/6W
R942	Resistor	CF,680Ω,±5%,1/6W
R943	Resistor	CF,1.2KΩ,±5%,1/4W
R944	Resistor	CF,360Ω,±5%,1/4W
R945	Resistor	CF,100Ω,±5%,1/6W
R946	Resistor	CF,9.1KΩ,±5%,1/6W
R947	Resistor	CF,4.7KΩ,±5%,1/6W
R948	Resistor	CF,9.1KΩ,±5%,1/6W
R949	Resistor	CF,4.7KΩ,±5%,1/6W
R950	Resistor	CF,9.1KΩ,±5%,1/6W
R951	Resistor	CF,4.7KΩ,±5%,1/6W
R952	Resistor	CF,5.6KΩ,±5%,1/6W
R953	Resistor	CF,5.1KΩ,±5%,1/6W
R954	Resistor	CF,10KΩ,±5%,1/6W
R956	Resistor	CF,680Ω,±5%,1/6W
R963	Resistor	FR,2.2Ω,±5% ,2W
R964	Resistor	CF,1KΩ,±5%,1/6W
R965	Resistor	CF,1KΩ,±5%,1/6W
R966	Resistor	CF,2.4KΩ,±5%,1/6W
R967	Resistor	CF,1.8KΩ,±5%,1/6W
R968	Resistor	CF,240Ω,±5%,1/6W
R969	Resistor	OMF,510Ω,±5%,1W
R970	Resistor	CF,56Ω,±5%,1/6W
RT01	Resistor	CF,1KΩ,±5%,1/6W
RT02	Resistor	CF,2.2KΩ,±5%,1/6W
VR112	Resistor	VR,5KΩ0.3W
VR351	Resistor	VR,10KΩ0.3W
VR353	Resistor	VR,1KΩ0.3W
VR354	Resistor	VR,1KΩ0.3W
VR401	Resistor	VR,10KΩ0.3W
VR442	Resistor	VR,5KΩ0.3W
VR451	Resistor	VR,2KΩ0.3W
VR454	Resistor	VR,200Ω,0.3W
VR455	Resistor	VR,10KΩ0.3W
VR456	Resistor	VR,20KΩ0.3W
VR458	Resistor	VR,20KΩ0.3W
VR481	Resistor	VR,5KΩ0.3W
VR901	Resistor	VR,5KΩ0.3W
VR902	Resistor	VR,5KΩ0.3W
VR903	Resistor	VR,50KΩ0.3W
VR904	Resistor	VR,5KΩ0.3W
VR905	Resistor	VR,5KΩ0.3W
VR906	Resistor	VR,5KΩ0.3W

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Location No.	Part.	Description
COILS & TRANSFORMERS		
L301	Coil	Choke,56uH,3142D (HA-56uH)
L401	Coil	Linearity,15T31A
L403	Coil	Ferrite Bead,3.3uH
L404	Coil	Choke,CH-900
L405	Coil	Choke,3155D
L406	Coil	Choke,3155D
L408	Coil	Choke,3155D
L410	Coil	Ferrite Bead
L411	Coil	Ferrite Bead
L801	Coil	De-Magnet,SLXC74-01
L811	Coil	Ferrite Bead
L812	Coil	Ferrite Bead
L911	Coil	Peaking,100uH
L912	Coil	Peaking,100uH
T401	Transformer	H47-HA
! T403	Transformer	Pulse,PT153KHA
! T462	Transformer	Flyback
! T801	Transformer	Line Filter,LCL35-HA
! T803	Transformer	Converter,DT-432-2HA
SEMICONDUCTORS		
Q101	IC	BA7078S
Q302	Transistor	RN1201
Q303	IC	LA7838
Q305	Transistor	2SC1815Y(2PC1815Y)
Q308	Transistor	2SC4793
Q309	Transistor	2SA1837
Q312	Transistor	RN2002
Q314	Transistor	2SA1015Y(2PA1015Y)
Q402	IC	LA7856
Q403	Transistor	2SC1815Y(2PC1815Y)
Q404	Transistor	2SK1385(2SK2649-01R)
Q408	Transistor	2SK525(2SK2382)
Q411	Transistor	2SC1815Y(2PC1815Y)
Q412	Transistor	2SC5612
Q413	Transistor	2SB688(2SA1940-O)
Q414	Transistor	2SA1015Y(2PA1015Y)
Q424	IC	4558DD(TA75559P)
Q435	Transistor	2SC1959
Q436	Transistor	2SA562
Q447	Transistor	2SC1815Y(2PC1815Y)
Q491	IC	KA3843B(UC3843)
Q4A2	Transistor	2SA1015Y(2PA1015Y)
Q801	IC	STR-M6511
Q802	Transistor	2SC1815Y(2PC1815Y)
Q821	IC	KIA7812P(TA7812S)
Q822	Transistor	2SC1815Y(2PC1815Y)
! Q823	Photo Coupler	S11ME5(TLP621-GR)
! Q826	Photo Coupler	TLP621-GR
Q827	IC	SE105
Q851	Transistor	2SC1815Y(2PC1815Y)
Q852	Transistor	2SC1815Y(2PC1815Y)
Q901	Transistor	2SC5147
Q902	Transistor	2SC1815Y(2PC1815Y)
Q903	Transistor	2SC5147

Location	Description

No.	Part.	
Q904	Transistor	2SC1815Y(2PC1815Y)
Q905	Transistor	2SC5147
Q906	Transistor	2SC1815Y(2PC1815Y)
Q908	Transistor	2SA1020
Q909	Transistor	2SC1815Y(2PC1815Y)
Q910	Transistor	2SC945(2SC1815Y)
Q912	IC	M52327SP
Q913	Transistor	2SA1015Y(2PA1015Y)
Q918	Transistor	2SC1815Y(2PC1815Y)
D101	Diode	Zener,2B4,2CW37
D102	Diode	Zener,2B4,2CW37
D213	Diode	1N4148
D214	Diode	Zener,20A,2CW37
D216	Diode	1N4148
D301	Diode	1N4001
D302	Diode	SC570A
D303	Diode	RGP10J
D401	Diode	FMV-3GMR
D402	Diode	RP3F
D406	Diode	1N4148
D407	Diode	HER104(1S1887)
D408	Diode	Zener,15A,2CW37
D409	Diode	Zener,16A,2CW37
D410	Diode	HER104(EU2A)
D413	Diode	1N4148
D414	Diode	1N4148
D416	Diode	1N4148
D417	Diode	Zener,15B,2CW37
D425	Diode	HER104(EU2A)
D426	Diode	HER104(EU2A)
D430	Diode	Zener,30S,BS72
D471	Diode	HER104(EU2A)
D480	Diode	Thyristor,BT169
D484	Diode	Zener,MTZJ27C
D4A1	Diode	1N4148
D4A2	Diode	1N4148
D4A3	Diode	1N4148
D4A7	Diode	1N4148
D4A8	Diode	1N4148
D810	Diode	HER308(EG01C)
D811	Diode	Bridge,4A 400V,KBL06
D812	Diode	Zener,5S1,BS72
D813	Diode	HER104
D814	Diode	HER104
D815	Diode	HER104
D816	Diode	Zener,30S,BS72
D817	Diode	Zener,10A,2CW37
D821	Diode	FML-G14S
D823	Diode	FML-G14S
D824	Diode	FMP-G12S(FMP-G12S)
D825	Diode	FMP-G12S(FMP-G12S)
D826	Diode	HER302
D827	Diode	Zener,15A,2CW37
D836	Diode	1N4148
D851	Diode	1N4148
D852	Diode	Zener,5S1,BS72
D901	Diode	1N4148
D902	Diode	1N4148

Location	Description

Display Unit 29E31S

No.	Part.	
D903	Diode	1N4148
D904	Diode	Zener,9A1,2CW37
D917	Diode	1N4148
D918	Diode	1N4148
D919	Diode	1N4148
D920	Diode	1N4148
D921	Diode	1N4148
D922	Diode	1N4148
D925	Diode	Zener,10A,2CW37

MISCELLANEOUS

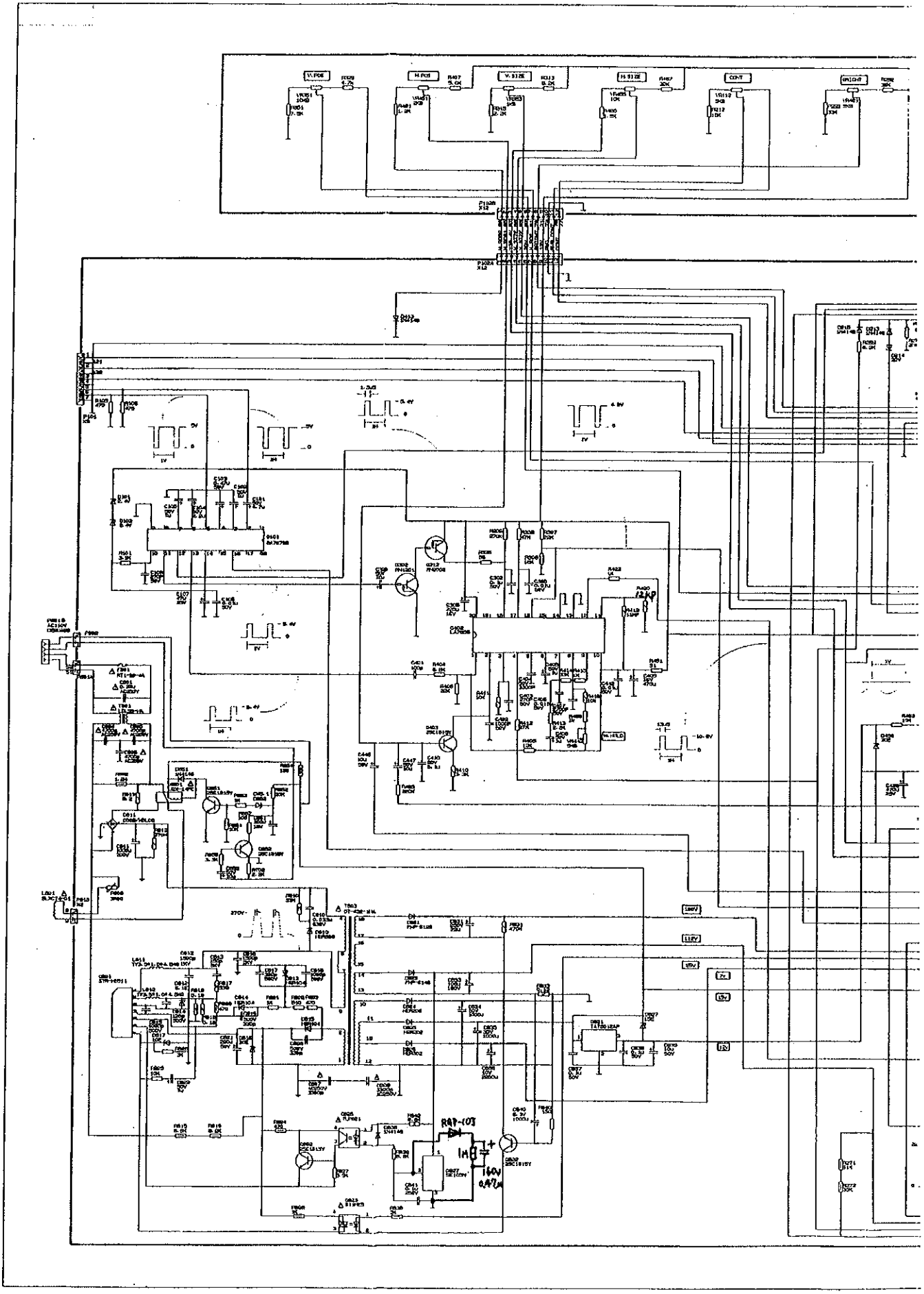
! F801	Fuse Holder	
! F801	Fuse	4A,'215004
K801	Relay	JQX-14FC-1Z
Q412E	sheet	M-45 or
P101A	Plug	PH-3A,2.0mm
P102A	Plug	TJC3-12A,2.5mm
P301	Plug	2663131
P401	Plug	B2P-LV-TN
P801A	Plug	B2P3-VH
P801B	Plug	176300-1
P802	Plug	XH-2A,2.5mm
P810	Plug	B2P-LV-TN
P901A	Plug	EH-4A,2.5mm
P902A	Plug	TJC1-1A
P902B	Plug	TJC1-1Y
P912A	Plug	PH-5A,2.0mm
P913A	Plug	TJC3-4A,2.5mm
P102B	Plug	EH-12AW,2.5mm
P912B	Wireharness	GD5,SCN-5P,2.5mm
B-B	Wire	WHITE(UL1007),AWG24
	Wireharness	GD6,UL1015AWG20,2P ,DY/V-Plug
	Wireharness	GD7,UL1015AWG18,2P ,DY/H-Plug
P901A	Wireharness	GD4,4P-3
P901B		
P102A	Wireharness	GD3,12P,VR Plug
P102B		
	Wireharness	15P,D-SUB Plug(VGA)

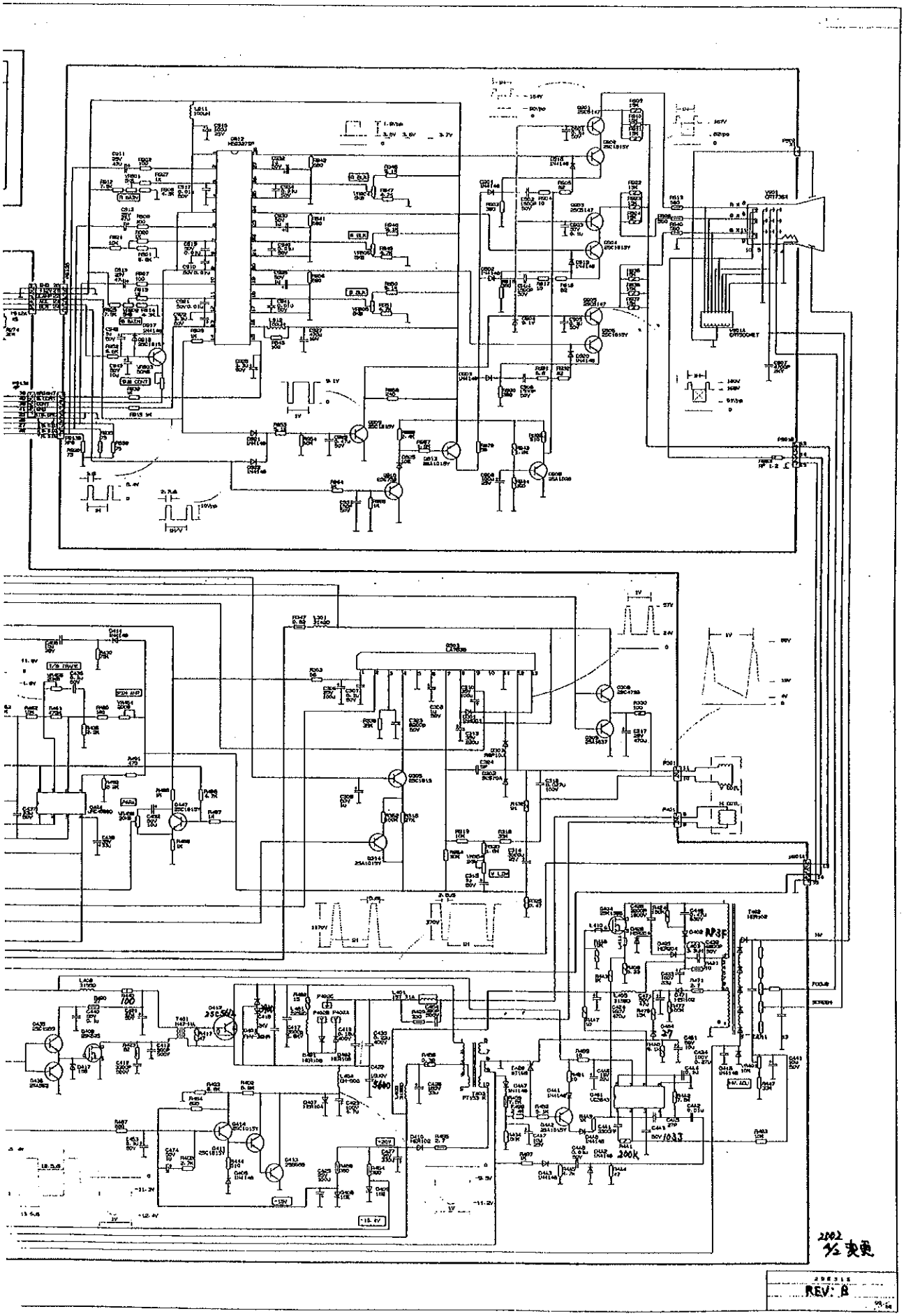
PC BOARD ASSEMBLIES

29E31S-A	Main Board,345 x 255
29E31S-B	CRT Drive Board,143x108
29E31S-C	Controls Board,199x33

PICTURE TUBE

! V901	Picture Tube	73SX701Y22 or 73SX706Y22 or 73SX707Y22 or A68KSM696X
! V901A	Picture Tube Socket	GZS10-2-4

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